Monitoring and Supporting Collaborative Groups to Enhance Student Outcomes

Anthony Joseph
Mabel Payne
Anthony Joseph, is Assistant Professor in the Computer Science Department based on the Manhattan campus. Dr. Joseph holds the Ph.D. from the City University of New York. His baccalaureate, masters, doctorate are in Electrical Engineering.

Dr. Joseph came to Pace University in 1999. His teaching specialties are in the areas of architecture and telecommunications. His research interests are in time-frequency analyses, neural networks with applications in economics and finance, bioinformatics, and applied pedagogy.

Mabel Payne is the Director of Research and Reporting in the Division of Assessment and Accountability of the New York City Department of Education. Ms. Payne holds a Masters of Science in Education, an Education Specialist certificate in Counseling and Student Personnel Services, and a Masters of Arts in Organizational Psychology.

Ms. Payne has been a public elementary and secondary education administrator since 1987. In 2001 she became the Director of Research and Reporting. In this capacity she provides a range of research and evaluation functions including: the supervision and coordination of external research requests; federal accountability reporting to the New York State Education Department; and activities to facilitate the understanding of district and school level accountability regulations and procedures as well as activities to facilitate the understanding of student assessment policies and procedures. Ms. Payne’s research specializations are statistical analyses and interpretation of group and interpersonal dynamics.
MONITORING AND SUPPORTING COLLABORATIVE GROUPS TO ENHANCE STUDENT OUTCOMES

Anthony Joseph, Ph. D¹ and Mabel Payne MS Ed., MA Org. Psych²

¹Pace University
New York, New York 10038, USA
²New York City Department of Education
New York, New York 10007, USA

ABSTRACT

This paper is offered to expand the collaborative learning and assessment literature to include monitoring, assessing, and supporting strategies and procedures for out-of-class collaborative student groups. The model is derived from a comparative study of the implementations of a computer organization course in 2001 and 2002 with the group as the unit of analysis. While in both semesters heterogeneous student collaborative groups participated in ongoing group interviews with the professor, their progress was more closely monitored in 2002 when a group grading roster and student journals were introduced. These enhancements resulted in more significant group correlation coefficients, greater group cohesion, and improved learning outcomes. The findings have application in both academia and industry.

KEYWORDS

Formative assessment, relative performance, percentage error, true value, group dynamics, collaborative group work, multiple intelligences, correlation coefficients, productivity, active learning

INTRODUCTION

Although the over 100 years of collaborative learning research (Johnson, Johnson, & Smith, 1998) is one of the most extensive in educational psychology (Dornyei, 1997) and collaborative
learning is known to promote social cohesion, motivation, and cognition (St. Clair & Tschirhart, 2002), we have found a dearth of research on monitoring and supporting collaborative learning groups designed to function outside of the classroom. To effectively and efficiently monitor and support collaborative learning groups, one needs to have a reasonably good knowledge of group dynamics (Henry, 2002). Group dynamics application to education is based on the following (Dornyei, 1997):

1. Most organized learning occurs in some kind of group (e.g. classes, seminars, workshops, discussion groups);
2. Group characteristics and group processes significantly contribute to success or failure in the classroom and directly affect the quality of learning within the group;
3. Theoretical and practical knowledge about group dynamics might assist teachers to create learning environments where learning is a rewarding and efficient experience. An awareness of the principles of group dynamics can also help teachers to make classroom events less threatening, develop more efficient classroom management, and develop creative, well balanced, and cohesive groups.

Group related activities are a growing phenomenon in both academia and industry—firms commonly use groups to foster creativity and increase productivity while lowering cost. However, groups do not naturally fit into these institutions’ traditional cultures (St. Clair & Tschirhart, 2002). Moreover, today’s students must be taught the skills and techniques needed to become life-long learners and effective team players to stay competitive in the job market of the global economy. These skills and techniques are best taught in a collaborative learning environment where the groups must be carefully designed, continuously monitored and supported, and become fully integrated into the course requirements (Johnson, Johnson, & Smith, 1998; Yuan & Benson, 2000).

This paper is offered to expand the collaborative learning and assessment literature to include monitoring, assessing, and supporting strategies and procedures for out-of-class collaborative student groups. The model is the culmination of a comparative study of the spring evening section of 2001 and 2002 implementations of a computer organization course. While in both semesters students were formed into heterogeneous collaborative groups, participated in ongoing group interviews with the professor, and were assigned a coordinator report, their group progress was more closely monitored during 2002 when a group grading roster and student journals were introduced and maintained. An analysis of percentage error values and correlation coefficients revealed the positive impact of the roster and the student journals. In addition, journal entries and interview data indicated greater group cohesion and learning outcomes during 2002.

**METHODS AND STRATEGIES**

Both administrative procedures and statistical methods were used in this study’s design. The students in the evening section of a computer organization course during the spring semesters of 2001 and 2002 were assigned to collaborative groups designed to foster interdependence and
improve their social and learning skills. Additionally, group coordinator role rotation and the professor’s [lead author’s] monitoring of within and between group performances were implemented to increase group cohesion. The statistical methods used were within group correlation coefficients and percentage error values for all course exams. These measures were chosen because of their capacity to show the relative performance of group members and groups to each other.

The spring 2001 and 2002 classes comprised 36 and 26 students respectively. During the third class session and subsequent to completing a professor-designed questionnaire, students were separated into groups. In spring 2001, there were ten groups with two to four members each. The 2002 students formed eight groups varying in size from two to four members. The grouping parameters were multiple intelligences, ethnicity, gender, course prerequisites, telecommunications or computer related work experience, previous degree and type, and intended time to devote to the course. In each course offering, multiple intelligences were held relatively constant within a group while the other parameters were left to vary. Therefore, students were provided with group members who approached new experiences in a similar manner to them, but they also had group mates who had unique backgrounds to assist them with their coursework. The coursework included all assignments, preparation for exams, and a group programming-based research project. Group activities were required to take place outside of the class. The groups were to stay together until the end of the course and to evolve into fully functioning study groups. All roles and group-related assignments were clearly delineated during the first class session. In both course offerings, each group had a coordinator who managed group activities. The coordinator role was rotational. It lasted three weeks and each student had an opportunity to serve in the role. At the end of a coordinator’s tenure, he or she submitted a coordinator assessment report, the contents of which were defined in the course materials. In addition, in the spring 2002 course, each student had to submit a journal detailing all of his or her course related activities. The journals were collected during the sixth and twelfth weeks of the semester.

During the 2001 semester, the professor provided feedback to each student group every three weeks starting from the sixth week in formal interviews. Each individual student’s performance was discussed in relationship to the other group members. Students also informed the professor of how well they felt their group was functioning. In the spring 2002 semester, in addition to providing the same rate of group feedback in formal interviews, the professor developed a group grading roster to be able to provide ongoing formative assessments of how each group was doing in comparison to the other groups and how its members’ achievement compared to one another. It was expected that overall group performance would improve over time as students collaborated on their assignments. Moreover, individual journals and coordinator assessments were used to compare and contrast group member assessment report data on student participation and commitment. These strategies helped the professor to provide targeted support so that group members might immediately improve their behavior to better assist one another, to improve their learning, and to enhance their group performance for the remainder of the semester.
Effective monitoring and supporting is defined by how well the group functions or collaborates. Therefore, the unit of analysis in this study was the group. There were two types of quantitative data, within group correlation coefficients and percentage error values. A correlation coefficient was computed for each group’s exam average and final exam grades. To the extent that students maintained their relative achievement ranks within their group, the correlation between any two grades was expected to be high. A correlation coefficient of + or - .70 was determined to be significant. However, this high rate of correlation would not necessarily be good if it meant that low performing group members never closed their achievement gaps with their higher performing group mates.

To better interpret relative group performance, a percentage error value was calculated for the same two indicators for which correlations were done. The formula for calculating a percentage error value is the following:

\[
\text{Percentage error} = \frac{[(\text{experimental value}) - (\text{true value})] \times 100}{\text{true value}}
\]

where

\[
\text{True value} = \frac{(\text{the mean average of the class exams}) \times (\text{the average of the final})}{\text{the mean average of all exams}}
\]

Each group member’s intra-group and inter-group performance was deemed acceptable if his or her percentage error value met three criteria:
1. Not be less than -10%,
2. Be within 15 points of each of the other group members percentage error value,
3. Be within + or - 10 points of the group’s average percentage error values.

**RESULTS**

In 2001, 24 out of 35 (68.6%) coordinator reports were submitted, as compared to 2002 when 21 out of 26 reports (80.8%), and 24 out of 26 (92.3%) journals were submitted. The coordinator reports, submitted before the scheduled interviews, were generally lacking in specifics on the group’s internal operation, members’ reactions to the number and type of assignments, members’ course expectations, the quality and fairness of the exams, the number and type of group meetings, and the value each member derived from the group experience. Compared to the 2001 cohort, the 2002 students submitted journals in addition to assessments. Therefore, there were multiple sources of information on all aspects of specific group activities, including statements indicating student feelings about other group members’ motivational levels, “I feel if we were to meet more often we can do much better.” Other statements showed with whom students met, including studying with groups other than those to which they were assigned and the frequency and type of assistance and collaboration they provided to each other. In addition, the formative assessment information from the group grading roster added specific group-based achievement
information to the interviews with the professor. The exam grades were organized within a group context, which enabled the professor to tell students content area performance information relative to the members in their group and their group’s performance relative to other groups. Students’ journal comments included reactions to their interviews with the professor, “He informed us that our group was the strongest in the class...My group started to strategize on how to keep the lead, and how to do the project well.” Roster information was also juxtaposed with student information about the frequency and type of meetings they had, i.e. electronic versus face-to-face.

In 2001, the students’ true value score was 81.4% compared to 73.7% in 2002, see Equation (2). Each year’s groups had five significant within group correlations of their exam averages and final grades. Using the three criteria for acceptable intra- and inter-group performance, three groups in 2002 and two groups in 2001 had appropriate percentage error values (see Table 1). Groups 2, 3, and 4 had appropriate exam average performance, group 1 had appropriate final exam performance, and group 5 had appropriate performance in both areas. In addition, groups 2, 3, and 4 had significant correlation coefficients, with respective values of 0.84, 1.00, and 0.84.

DISCUSSION

The information obtained in the 2002 formal interviews was more concrete than in 2001. Students’ journal entries provided a fuller dimension than the coordinator assessment reports to their group work reflection as well as insights into the impact of the course and its instructional strategies. The group grading roster enabled the professor to provide specific observations about group achievement outcomes because he was viewing students’ course performance within a group, rather than individual context. In addition, the roster information partially inspired inter-group competition and increased the professor’s ability to corroborate coordinator reports with journal entries, and formative group assessments.

The 2001 students’ higher true value score indicates that as individuals they had better academic achievement than the 2002 students. However, the correlation coefficient and percentage error data indicate a higher percentage of 2002 groups collaborated than in 2001. When group quantitative and qualitative data substantiate each other they provide a robust measure of collaboration. Group 1 in Table 1 is such a group. Their journal entries and interview data corroborate their correlation and percentage error performance data.

In the 2002 implementation of the course, the professor engaged in extensive coaching and facilitating behaviors. This method of instruction is highly regarded in the assessment and learning literature (Yuan & Benson, 2000; St Clair & Tschirhart, 2002; Henry, 2002). However, almost all of these sources highlight in-class activities to support and assess collaborative student group work. This study adds to the literature by using out-of-class monitoring, assessing and supporting activities to assist out-of-class collaborative student groups. This method requires extensive preparation and student contact. However, the benefits of these strategies were largely substantiated by the students’ journal entries concerning social and administrative skills acquired
or reinforced, and the amount of course information they were able to learn. These outcomes have application in both academia and the world of work. As such they can be viewed as one step along the continuum toward better human relationships and enhanced productivity.

Table 1
Selected Percentage Error Values

<table>
<thead>
<tr>
<th>Group Number</th>
<th>2002 Exam Averages</th>
<th>Final Exam</th>
<th>2001 Group Number</th>
<th>Exam Averages</th>
<th>Final Exam</th>
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<tbody>
<tr>
<td>Group 1</td>
<td>42.5</td>
<td>7.2</td>
<td>Group 4</td>
<td>5.6</td>
<td>22.8</td>
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<tr>
<td></td>
<td>38.4</td>
<td>20.8</td>
<td></td>
<td>1.9</td>
<td>-17.7</td>
</tr>
<tr>
<td></td>
<td>33.0</td>
<td>8.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>25.3</td>
<td>7.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>34.8</td>
<td>11.0</td>
<td>Average</td>
<td>8.7</td>
<td>17.9</td>
</tr>
<tr>
<td>Group 2</td>
<td>30.3</td>
<td>-13.2</td>
<td>Group 5</td>
<td>-8.7</td>
<td>-0.5</td>
</tr>
<tr>
<td></td>
<td>37.7</td>
<td>23.5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>43.8</td>
<td>19.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>37.3</td>
<td>9.9</td>
<td>Average</td>
<td>5.2</td>
<td>-0.5</td>
</tr>
<tr>
<td>Group 3</td>
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<td></td>
<td>6.0</td>
<td>1.9</td>
</tr>
<tr>
<td></td>
<td>11.9</td>
<td>19.4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>7.5</td>
<td>9.3</td>
<td>Average</td>
<td>0.8</td>
<td>0.3</td>
</tr>
</tbody>
</table>

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